

## RESPONSES OF FERAL PIGS TO TRAP TYPES AND FOOD BAITS

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Live-capture of free-ranging animals by mechanical methods necessitates the use of suitable devices which will efficiently catch and hold the animal unharmed. Unlike kill-trapping, live-trapping provides live animals for direct examination; tagging in mark-recapture studies for determination of abundance, movement, and distribution; sampling, such as the collection of parasites or blood; and studies on growth of individuals.

When live-trapping methods are used to estimate density, the number of captures over the time period, i.e., trappability, may be biased by two groups of factors (Gliwicz 1970). The first group of factors may be called population-dependent factors. The animals' density, their distribution, social organization, and individual differences in behavior to trapping devices as a result of differences in physiology, age, or sex will generally affect trappability. These factors are outside the control of researchers. The second group of variables may be termed method factors. Trap design, triggering mechanism, efficiency, placement, number, baits, and baiting techniques all affect the total number of capture. The latter group of factors is within the control of the researcher. It is the purpose of this paper to report some observations on responses by feral pigs (Sus scrofa L.) to different live-trapping methods and food baits. Capture-recapture data are not presented in this report but will appear in a subsequent report detailing their analysis and interpretation for the evaluation of the feasibility of live-trapping as a management tool in a feral pig control program.

### Types of Live-traps

Three kinds of traps were used in a catch-mark-release study for estimation of pig abundance and were evaluated also for their effectiveness. These traps included 20 box traps (16 of which were metal and four wooden), three corral traps, and six foot-hold spring snares. Except for one metal box trap donated by Haleakala National Park (HALE), all the other wooden and metal box traps were designed and constructed specifically for this study.

## TRAPS

Materials and Methods1. Box Traps - (a) Metal

Metal box traps were completely sectional, portable, and equipped with a one-way, upward swing door which allowed capture of subsequent animals after the initial catch (Diong 1981). After closure, the door rested against the bottom door frame and was prevented from swinging outwards but allowed an animal from the outside to enter by pushing the door inwards. These traps were equipped with a dual triggering mechanism.

The more successful and frequently used of the trigger systems was the root-bar system. Here, two sticks about 18 inches in length were taken and a notch was made about 3 inches from one end of each stick. The longer ends were then driven into the ground 18 inches apart with the notches facing the rear of the trap 6 inches above the ground. A cross-bar was then inserted horizontally into the notches. A rope, fastened to the cross-bar at one end, was passed over the trap's top-piece cross-bar before being secured to the bottom frame of the trap door. On entering the trap, the pig has to disengage the cross-bar to release the door.

In the pull-pin trigger mechanism, one end of the rope was tied to the rear end of the pull-pin (also used to lock the door in position); the rope was then run over the cross-bars of the trap's top-piece through a metal ring with the other end of the rope fastened to the bait. The bait was normally suspended in mid-air. Here the animal has to pull the bait to release the pin thereby closing the door.

The trap donated by Haleakala National Park for this study was found to have a faulty door mechanism. A correction to the door was made and the root-bar trigger mechanism was used.

1. Box Traps - (b) Wooden

These traps have the same dimensions as the metal ones. Two of them were equipped with a plywood drop-door. The trigger mechanism works as follows. One end of a rope was fastened to the chain-link fabric on the floor of the trap, whilst the other end was tied to a nail inserted through the lower end of the plywood door. The trigger rope has to be taut. When the trigger rope is disturbed, the nail is disengaged, releasing the sliding door for trap closure.

## 2. Corral Traps

Corral traps were constructed around trees which were used as vertical supports and door-posts. The size of the corrals was kept small to facilitate handling of animals. The sides were doubled up with hog wire to approximately 5 feet 6 inches. Stem sections were woven down and alternately through the horizontal strands of the hog wire before planting them into the ground. All the corrals were equipped with one-way swing doors and the root-bar trigger mechanism.

## 3. Foot-hold Spring Snares

A reliable foot-hold spring snare first designed and used by the British in the Orient for catching ungulate species was considered for use but abandoned because cylindrical holes dug in the ground as part of the foot-hold trigger mechanism were found to cave in, setting off the trigger or dislodging stakes planted in the ground. Instead, two kinds of steel snares were used. One had a release-peg which held the snare loop on the ground maintaining the tension in the trigger wire when the snare is set. Snare-setting was done by bending down a flexible branch of a tree and triggering the wire to a release mechanism similar to that used in the metal box traps. When the cross-bar was released, the branch sprung back into its original position tightening its noose around the animal.

## Results

### Responses to Trap Types

The behavioral responses of feral pigs to the above trap types were observed mainly from direct and indirect signs the animals left behind, such as tracks and partially consumed bait inside and outside the trap.

### 1. Trap Wariness

The animals showed caution in approaching and entering the trap. Wary animals left clear and distinct tracks outside the trap entrance and inside the front end of the trap. Baits outside the trap were usually eaten; occasionally, baits along the bait trail leading to the trigger mechanism were also consumed either inside the trap or taken out. In almost every case, trap wariness was found to be caused by the chain-link fabric being off the ground. This happened because of rain-wash, animal trampling after several captures, and ground unevenness or rockiness. Animals walking into such a trap will experience the fabric well above their toes and in the case of larger animals, tight around their legs. This trap response was counteracted by either re-locating the trap or shovelling soil onto its floor. Trap wariness was not observed in corrals. Unlike box traps, existing

corrals have no bottom fabric or threshold at the entrance. Pigs have been observed to root directly into corrals even when unbaited.

## 2. Trap Trigger Avoidance

This behavior was frequently observed in traps with a drop-door mode of capture but was less of a problem in those traps with root-bar trigger mechanism. Bait theft from inside a trap was commonly observed. With hāpu'u or coconuts, the bait was frequently taken and eaten out of the trap. Counter measures, such as placing the bait at the very rear end of the trap, were less successful than two other measures, i.e., tying the bait to the trigger rope, or passing the trigger rope over the cross-bar of the trap before fastening it to the floor fabric vertically below. The latter of these two measures appeared to reduce the prominence of the trigger rope and was found to be effective. With other box traps, trigger avoidance, when observed, was counteracted by alternating the pull-pin mode of baiting with that of the root-bar.

## 3. Trap Entry Reluctance

Unwillingness to approach and enter a trap was found to be dependent on the firmness of the ground around and especially in front of the trap door. Two traps located on low-lying ground and on ponded sites sank up to 6 inches. Rooting around the trap, poor drainage, and frequent ground disturbances from repeated captures and manhandling operations during rainy weather produced mud-pools up to knee-deep around the trap. These mud-pools acted as obstacles between approaching animals and trap entrances hence deterring entry. In cases like these, the trap was disassembled and moved to another site.

## 4. Trap Habituation

This term was applied to those animals captured more than once in the same trap in which they were first caught. The extreme case of this behavior was shown by only two animals first caught as piglets in two separate traps and ear-tagged 1024-12 and 2005-3. They were each recaptured five and four times, respectively, over an 8 month period. A change of bait was ineffective in reducing capture proneness.

## 5. Door Lifting

In two of the corrals, pigs were observed to escape by lifting the swing door. Laying barb-wire on the inside lower portion of the door effectively counteracted this behavior.

Except for young piglets which have been known to squeeze themselves out of the trap, all box traps were escape-proof and

held the animals without damaging them. Animals caught in the corrals generally made more attempts to escape and hence the higher incidence of bleeding on the snout.

Snared animals were mutilated or fractured and dead within a day of capture. Although the snares were intended to catch the animals by the leg, snaring around the neck, and in the case of piglets around the body, were also observed. Escape of animals from the snares have taken place on occasions when there was insufficient tension in the trigger wire. With good tension, snaring is escape-proof and is more appropriate for kill-trapping but undesirable in mark-recapture studies.

## FOOD BAITS

### Materials and Methods

Presence of bait in trapping devices explains part of the variability in trap response. While certain baits elicit higher trap response than others, failure of capture may actually be explained by the ineffectiveness of the bait. In general, a bait should function to attract the animal's attention and induce it into the baited trap. Food, sound, curiosity, or sexual excitement as when a live-bait is used, are some forms of inducement.

With box and corral traps, baiting was done by concentrating fairly generous amounts of bait at the trigger mechanism and outside the trap. A bait line was created by scattering the bait from the trigger point to outside the trap. Bait was scored as attractive or unattractive. Attractiveness was measured by monitoring rooting activity within an area of radius 50 feet from the baited trap. The 50 feet were taken as the bait recognition distance. The bait was scored as unattractive if no animal was caught in the trap even though activity was observed within this area from the time the trap was baited to the time it was inspected. In addition, the effectiveness of each bait was evaluated by observing the length of time the food item was good as a bait (i.e., bait-life); nuisance problem; and availability. A total of six types of baits was tested.

### Results

#### Responses to Types of Baits

##### 1. Pig Carrion

The idea of a self-sustaining trap in which a trapped animal dies to attract another animal is an attractive management idea for controlling noxious animals. This concept was investigated in one trap and the observation extended to baiting other types

with pig carcasses and monitoring pig responses to pig carrion in the field. An adult sow trapped in a multi-catch trap was allowed to die. The carrion produced an odor which carried far and by the sixth day, the carrion was heaped with maggots. Although there was heavy activity around the area and within the bait recognition area, the carrion was not attractive or self-baiting. Pig carcasses without the entrail were also used as bait but was not effective. No pig has been caught in meat-baited traps. In every instance, such meat-baited traps had to be cleaned of the carrion or relocated in another locality before subsequent use. Pigs that were shot were monitored to study meat-bait responses. Pigs were not attracted to this bait whether freshly killed or decaying. In addition to pig meat for bait, beef scraps were also used. Beef-baited traps did not attract or capture any pig. This observed behavior is contrary to that reported by Hone and O'Grady (1980) for feral pigs in New South Wales, Australia, where pig carrion was a choice bait and traps became self-baiting when a trapped animal died. In the rain forest environment in Kipahulu Valley, earthworms, which are abundant and occur in large numbers on the ground and in the top soil, form a readily available and important source of protein for the animal. Therefore, carrion is less attractive to the pigs.

## 2. 'Ie'ie

The 'ie'ie (*Freycinetia arborea* Gaud.) is an important food and cover plant for rain forest pigs. Feeding on this plant involves removal of the older basal leaves and feeding on the shoot tip and younger leaves. The spirally arranged leaves may contain up to as many as 10 earthworms of one species, which are also eaten. The 'ie'ie is abundant in some areas below 1300 m (4000 ft). It is good as a food bait for about five days becomes unattractive with the browning of the leaves.

## 3. Coconut, Corn, and Molasses

Three novel items were introduced as food baits: coconuts, shelled corn, and molasses. Coconuts which are abundant outside the study area, need to be picked and husked before packing. If kept dry, the fruit will be good for up to four months. The nuts were cracked to expose the kernel which lasts for about four to six days before becoming rancid. Rats frequently visited the coconut-baited traps and rebaiting became necessary for some traps. Shelled corn had a bait-life of about five to eight days and was attractive bait when it became fermented, especially when mixed with molasses. The main disadvantage was that shelled corn was prone to being washed away, buried in mud during heavy rain, and consumed by rats and cannot be used in traps which had sunk or were flooded. Molasses when heated and poured on traps made an attractive bait which induced bait-licking. It had the shortest bait-life and was unsuitable for use in the wet and rainy environment.

#### 4. Tree Ferns

Tree ferns or hāpu'u (*Cibotium* spp.) are one of the most impacted food plants in the rain forest habitats. Baiting involved cutting two half-foot lengths of the stem into longitudinal wedges of eighths to expose their starchy core. This bait is most readily eaten by pigs and has a bait-life of four to eight days. When it browns and becomes moldy the bait is no longer effective. Rats were observed to feed on the hāpu'u core but rebaiting was never necessary. Bite direction was observed to be lengthwise when the food bait was halved longitudinally but became cross-wise when the longitudinally cut wedges became progressively acute. With the stated criteria for bait evaluation, tree ferns with their exposed cores were found to be the most effective and choice bait, followed by coconuts, shelled corn, 'ie'ie, and molasses. As stated above, pig carrion was not an effective bait.

### DISCUSSION

#### Some Management Considerations

Reactions of pigs to food baits provides useful information on the favored and alternative baits which could be used in control programs using live- or kill-trapping methods. When poisoning programs are considered, favored baits could be inoculated with the desired poison. In parts of Australia, pig and animal carrion were found to be a very effective bait for feral pigs. Meat baits inoculated with 1080 (Sodium monofluoroacetate) and air-dropped into the animals' range were highly successful in pig eradication operations (Bisset 1977). In Hawai'i, tree ferns--the favored food item--may be similarly inoculated for use in a poisoning program as follows. Lengths of tree fern trunks were halved longitudinally (Fig. 1). Triangular incisions were made on the cut surface of the core at regular intervals forming pyramidal cones which were then carefully dislodged. A bit was then used to bore cavities in the core. Into each cavity a size 000 telescopic gelatin capsule, loaded with sugar, was inserted. The pyramidal cones were then replaced to seal the entrance of the cavities. Inoculated baits like these have been eaten by pigs in the field and demonstrated some potential for chemical control.

Traps and snares have been used with some success in controlling feral pigs. When used with other control methods, like direct reduction, containment, or exclusion, trapping within a multi-approach operation can be more effective. The important question for which research data must be available when considering traps for pig control is: when to use how many of what kinds of traps at what place.

The when implies that certain months of the year would be more effective and strategic in impacting the population by trapping. Activity and movement patterns increase in response to the fruiting season of strawberry guava (Psidium cattleianum Sabine) at lower elevations. A higher percentage of pregnant, lactating females, either with their yet unweaned or weaned litters were caught during certain months of the year. Continuous heavy rain appears to restrict pigs in smaller areas for a short period of time. The how many refers to the number of traps. Theoretically, the number of animals that could be trapped would depend on the number of traps, population density, size of home range, and their distribution, other variables described in this paper being constant. Important considerations for what kinds of traps are trap efficiency, durability, portability, and convertibility. To be effective, a trap has to catch; to be durable, it has to be lasting, hold the catch, and be trouble-free; to be portable, it has to be dismountable; and to be productive, it should be capable of conversion into larger traps. The metal box traps used in this study meet these criteria but multiple capture has exceptions and is not always a rule. With captures in box traps and corrals, but not in snares, pigs have been observed to stay around the trap site. In areas of high density, it is recommended that several traps be assembled or placed together to increase trap efficiency. Finally, what place indicates that some areas of the animals' range are preferred to others for trap placement. Ideally, these should be core or home-site areas of the animals' home range. Telemetry-determined home ranges showed that the present placement of traps along the central escarpment trail in Kipahulu Valley is less than ideal for maximum trappability. The central escarpment acts as a physical barrier to lateral movement and is on the edge of the animals' home range. Successful trapping, therefore, combines the knowledge of the animals' ecology and the use of suitable mechanical devices.

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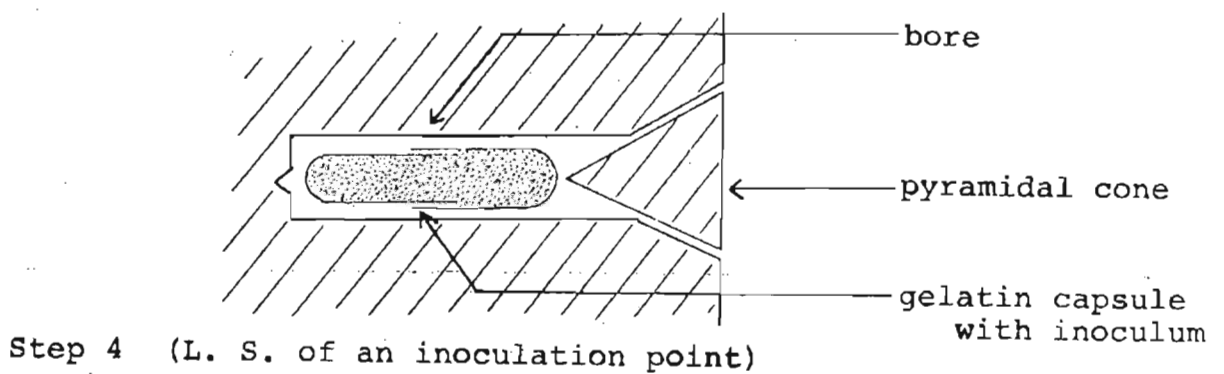
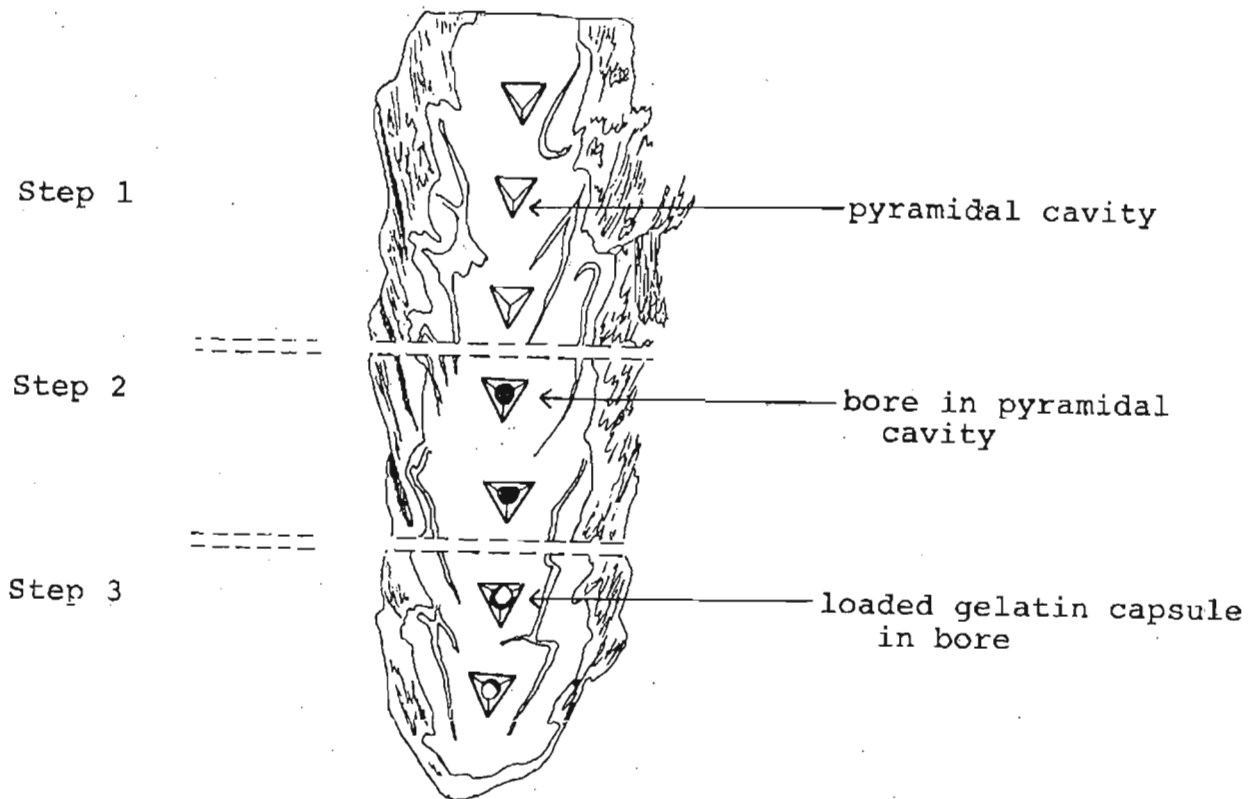


FIGURE 1. Preparation procedures for inoculation of a tree fern section.

- Step 1 - incising tree fern cone for pyramidal cavities;
- Step 2 - drilling in cone cavity to produce a cylindrical cavity;
- Step 3 - insertion of loaded gelatin capsule in bore; and
- Step 4 - capping inoculated pyramidal cavity with pyramidal cones.